Appendix G

Performance of Past *IEO* Forecasts for 1990 and 1995

In an effort to measure how well the *IEO* projections have estimated future energy consumption trends over the series' 17-year history, we present a comparison of *IEO* forecasts produced for the years 1990 and 1995. The forecasts are compared with actual data published in EIA's *International Energy Annual 1999*,[32] as part of EIA's commitment to provide users of the *IEO* with a set of performance measures to assess the forecasts produced by this agency.

The *IEO* has been published since 1985. In *IEO85*, mid-term projections were derived only for the world's market economies. That is, no projections were prepared for the centrally planned economies (CPE) of the Soviet Union, Eastern Europe, Cambodia, China, Cuba, Laos, Mongolia, North Korea, and Vietnam. The *IEO85* projections extended to 1995 and included forecasts of energy consumption for 1990 and 1995 and primary consumption of oil, natural gas, coal, and "other fuels." *IEO85* projections were also presented for several individual countries and subregions: the United States, Canada, Japan, the United Kingdom, France, West Germany, Italy, the Netherlands, other OECD Europe, other OECD (Australia, New Zealand, and the U.S. Territories), OPEC, and other developing countries. Beginning with *IEO86*, nuclear power projections were published separately from the "other fuel" category.

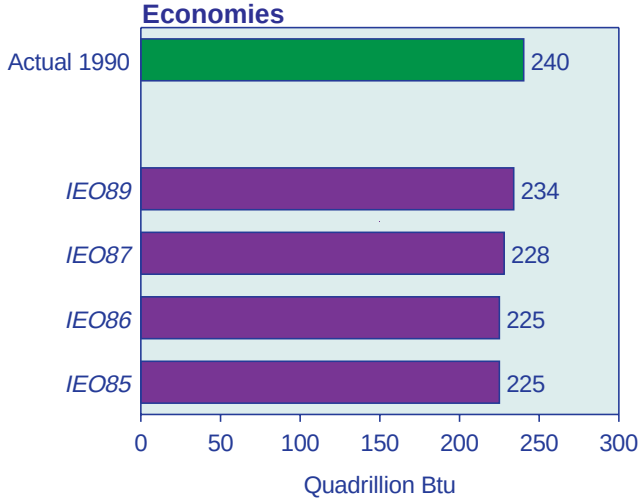
The regional aggregation has changed from report to report. In 1990, the report coverage was expanded for the first time from coverage of only the market economies to coverage of the entire world. Projections for China, the former Soviet Union, and other CPE countries were provided separately.

Historical data for total regional energy consumption in 1990 show that the *IEO* projections from those early years were consistently lower than the actual data for the market economies. For the four editions of the *IEO* printed between 1985 and 1989 (no *IEO* was published in 1988) in which 1990 projections were presented, total projected energy consumption in the market economies ran between 3 and 7 percent below the actual amounts published in the *International Energy Annual 1999* (Figure G1).

In addition, market economy projections for 1995 in the 1985 through 1993 *IEO* reports (EIA did not release forecasts for 1995 after the 1993 report) were consistently lower than the historical 1995 data (Figure G2). Most of the difference is attributed to those market economy countries outside the Organization for Economic Cooperation and Development (OECD). Through the years, EIA's economic growth assumptions for OPEC and other market economy countries outside the OECD have been low. The 1993 forecast was, as one might expect, the most accurate of the forecasts for 1995, but its projection for OPEC and the other market economy countries was still more than 10 percent below the actual number.

IEO90 marked the first release of a worldwide energy consumption forecast. Since *IEO90*, the forecasts for worldwide energy demand have been between 2 and 5 percent higher than the actual amounts consumed (Figure G3). Much of the difference can be explained by the unanticipated collapse of the Soviet Union economies in the early 1990s. The *IEO* forecasters could not foresee the extent to which energy consumption would fall in this region. In *IEO90*, total energy consumption in the FSU was projected to reach 67 quadrillion Btu in 1995. The projection was reduced steadily in the next three *IEO* reports, but even in 1993 energy demand for

Figure G1. Comparison of *IEO* Forecasts with 1990 Energy Consumption in Market Economies



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 1999*, DOE/EIA-0219(99) (Washington, DC, February 2001). **Projections:** EIA, *International Energy Outlook*, DOE/EIA-0484 (Washington, DC, various years).

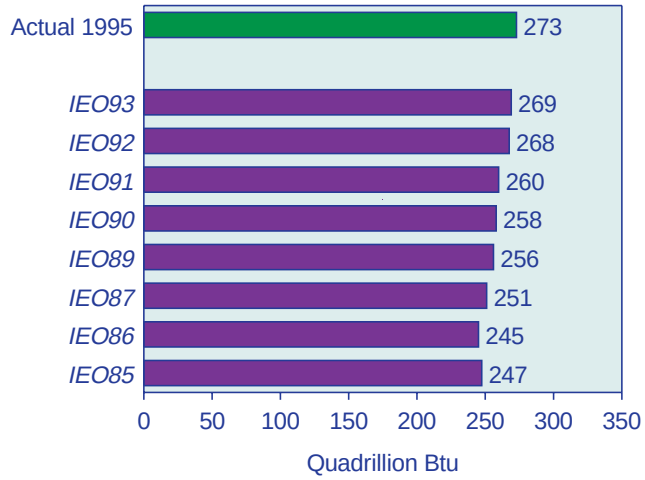
[32]Energy Information Administration, *International Energy Annual 1999*, DOE / EIA-0219(99) (Washington, DC, February 2001).

1995 in the FSU region was still projected to be 53 quadrillion Btu, as compared with actual 1995 energy consumption of 43 quadrillion Btu, some 10 quadrillion Btu (or about 5 million barrels of oil per day) less than projected in *IEO93*.

Considering the forecasts for the year 1995 strictly in terms of depicting future trends associated with the fuel mix, the *IEO* reports have performed well. Each *IEO* since 1990 has projected the fuel mix within 3.5 percentage points of the actual 1995 mix. The earliest *IEO*s tended to be too optimistic about the growth of coal use in the market economies[33] (Figure G4), and not optimistic enough about the recovery of oil consumption after the declines in the early 1980s that followed the price shocks caused by oil embargoes in 1973 and 1974 and the 1979-1980 revolution in Iran (Figure G5). The *IEO85* and *IEO86* reports projected that oil would account for only about 40 percent of total energy consumption for the market economies in 1995, whereas oil actually accounted for 45 percent of the total in 1995.

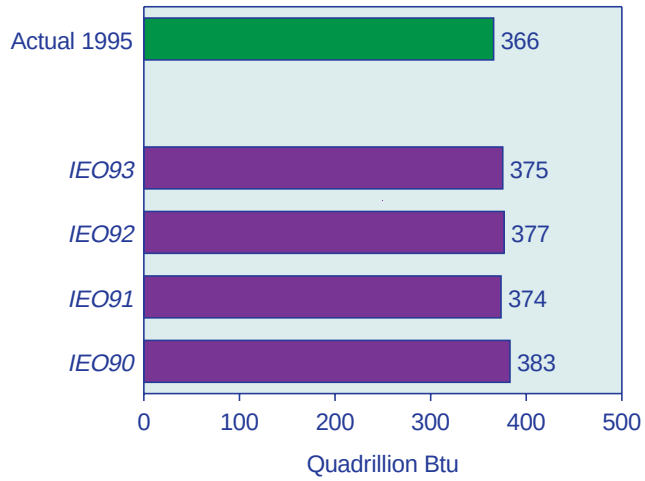
The forecasts for world coal consumption that appeared in the *IEO*s printed between 1990 and 1993 were consistently high, between 4 and 16 percent higher than actual coal use (Figure G6), largely because of overestimates for the former Soviet Union and Eastern Europe—regions that experienced substantial declines in coal consumption during the years following the collapse of the Soviet Union. Most of the by-fuel projections for the FSU were greater than the actual consumption numbers, with the exception of hydroelectricity and other renewable resources (Figure G7). Natural gas use did not decline as much as oil and coal use because gas is a plentiful resource in the region and was used extensively to fuel the domestic infrastructure, but even the *IEO* estimates for 1995 natural gas use were 16 to 22 percent higher than the actual use.

Figure G2. Comparison of *IEO* Forecasts with 1995 Energy Consumption in Market Economies



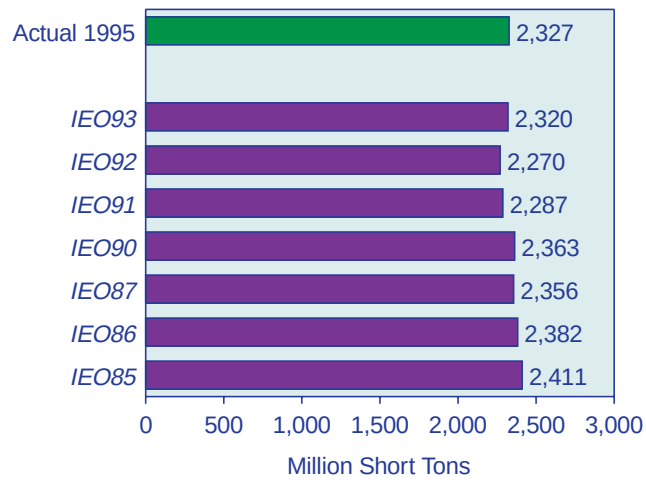
Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 1999*, DOE/EIA-0219(99) (Washington, DC, February 2001). **Projections:** EIA, *International Energy Outlook*, DOE/EIA-0484 (Washington, DC, various years).

Figure G3. Comparison of *IEO* Forecasts with 1995 World Energy Consumption



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 1999*, DOE/EIA-0219(99) (Washington, DC, February 2001). **Projections:** EIA, *International Energy Outlook*, DOE/EIA-0484 (Washington, DC, various years).

Figure G4. Comparison of *IEO* Forecasts with 1995 Coal Consumption in Market Economies



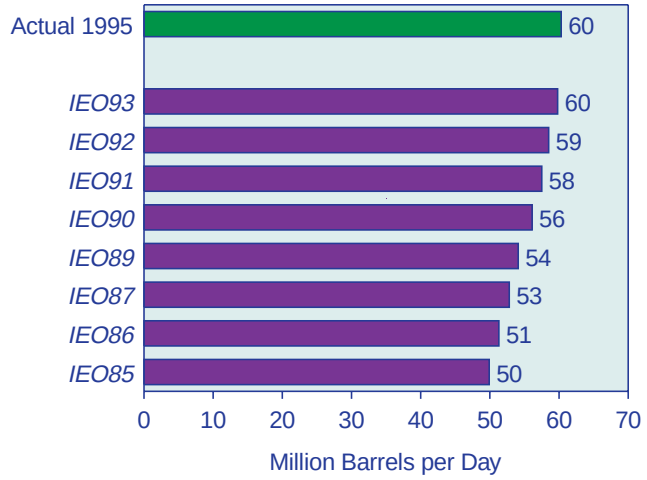
Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 1999*, DOE/EIA-0219(99) (Washington, DC, February 2001). **Projections:** EIA, *International Energy Outlook*, DOE/EIA-0484 (Washington, DC, various years).

[33]Projections for West Germany and later unified Germany have been removed from the values considered here because of the lack of continuity in the coal data series after reunification.

The EIA projections for total energy consumption in China were below the actual 1995 consumption level in *IEO90* (by 13 percent) and *IEO91* (by 8 percent) but higher in *IEO92* (by 6 percent) and about the same in *IEO93*. The underestimates in the earlier *IEO*s balanced, in part, the overestimates for the EE/FSU countries; however, even the 4- to 17-percent underestimate of projected 1995 coal use in China could not make up for the 30- to 54-percent overestimate of FSU coal use. In terms of other fuels, EIA consistently overestimated China's gas consumption and underestimated its oil consumption. Nuclear power forecasts were fairly close for China, within 5 percent of the actual consumption (Figure G8). It is noteworthy, however, that consumption of natural gas and nuclear power was quite small in 1995, so that any variation between actual historical consumption and the projections results in a large percentage difference. EIA consistently underestimated economic growth in China. As late as 1993, EIA expected GDP in China to grow by about 7.3 percent per year during the decade of the 1990s, whereas it actually grew by 10.7 percent per year between 1990 and 1995.

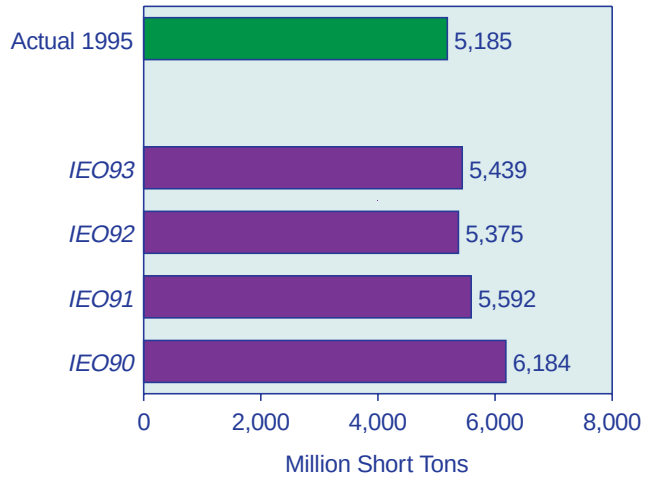
The comparison of *IEO* projections and historical data in the context of political and social events underscores the importance of these events in shaping the world's energy markets. Such comparisons also point out how important a model's assumptions are to the derivation of accurate forecasts. The political and social upheaval in

Figure G5. Comparison of *IEO* Forecasts with 1995 Oil Consumption in Market Economies



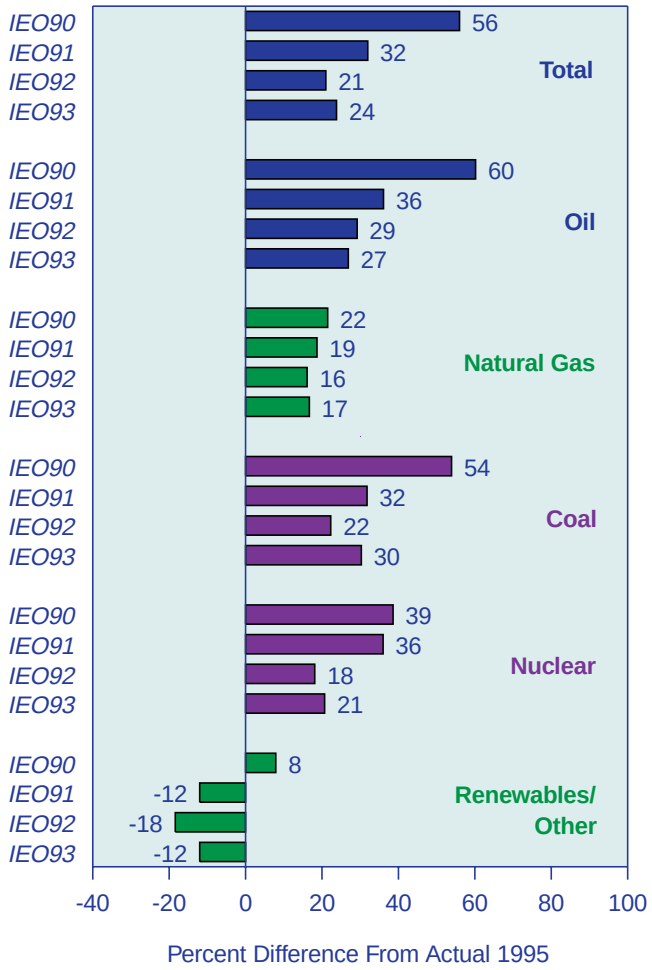
Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 1999*, DOE/EIA-0219(99) (Washington, DC, February 2001). **Projections:** EIA, *International Energy Outlook*, DOE/EIA-0484 (Washington, DC, various years).

Figure G6. Comparison of *IEO* Forecasts with 1995 World Coal Consumption



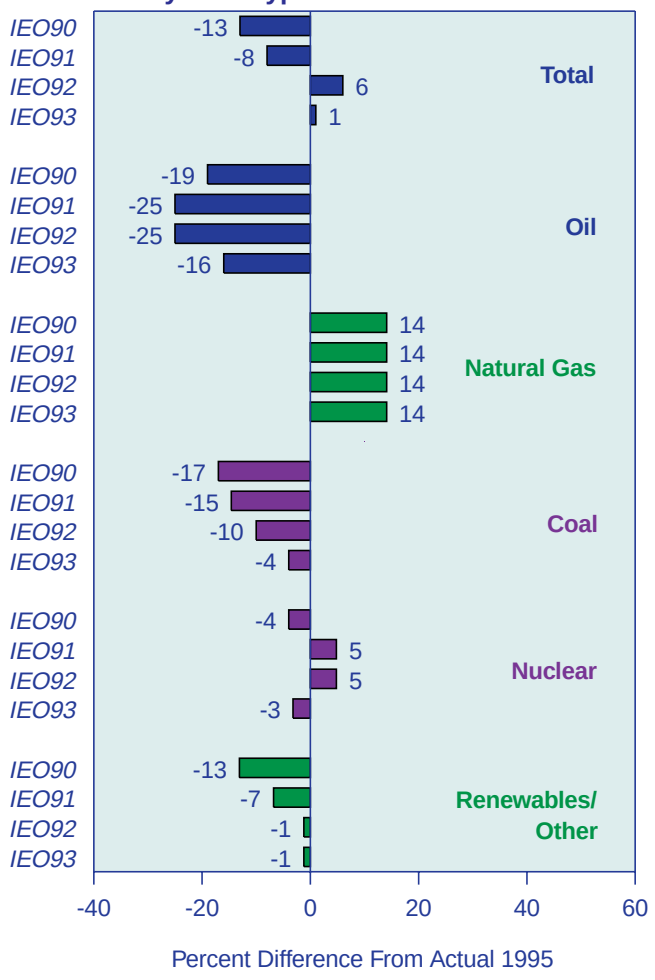
Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 1999*, DOE/EIA-0219(99) (Washington, DC, February 2001). **Projections:** EIA, *International Energy Outlook*, DOE/EIA-0484 (Washington, DC, various years).

Figure G7. Comparison of *IEO* Forecasts with 1995 Energy Consumption in the Former Soviet Union by Fuel Type



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 1999*, DOE/EIA-0219(99) (Washington, DC, February 2001). **Projections:** EIA, *International Energy Outlook*, DOE/EIA-0484 (Washington, DC, various years).

Figure G8. Comparison of *IEO* Forecasts with 1995 Energy Consumption in China by Fuel Type



Sources: **History:** Energy Information Administration (EIA), *International Energy Annual 1999*, DOE/EIA-0219(99) (Washington, DC, February 2001). **Projections:** EIA, *International Energy Outlook*, DOE/EIA-0484 (Washington, DC, various years).

Eastern Europe and the former Soviet Union was not predictable, and it dramatically affected the accuracy of the projections for the region. If higher economic growth rates had been assumed for China, more accurate forecasts for that region might have been achieved. It is important for users of the *IEO* or any other projection series to realize the limitations of the forecasts. Failing an ability to predict future volatility in social, political, or economic events, the projections should be used as a plausible path or trend for the future and not as a precise prediction of future events.